MACHINE FOR FILLING AND SEALING TWO-PART CAPSULES

[0001] Prior Art

[0002] The invention is based on a machine for filling and sealing two-part capsules of the type defined in further detail in the preamble to claim 1.

[0003] Such a machine is known in the industry and is used in the pharmaceutical field for filling capsules, comprising a lower capsule part and an upper capsule part, with a medication that is for instance in powdered form. The machine includes a plurality of work stations, through which capsules located on a delivery device pass; the delivery device for instance comprises a first feed wheel, provided with receptacles for the lower capsule parts, and a second feed wheel, provided with receptacles for the upper capsule parts.

[0004] The work stations include at least one capsule separating station, at which the upper capsule part is separated from the lower capsule part; a filling station for filling the lower capsule part with the powder, a capsule closing station, at which the upper capsule part is placed back on the lower capsule part again, a capsule inspection station, at which the capsules are inspected for their quality and fill status, and a capsule expulsion station, at which the capsules are removed from the capsule delivery device.

[0005] The capsule expulsion station is designed such that depending on their quality ascertained in the inspection station on the one hand, the capsules can be expelled into a

container associated with a bad side for so-called bad capsules, that is, defective capsules, and on the other into a container associated with a good side for so-called good capsules, that is, capsules that are free of defects. For this purpose, the capsule expulsion station includes tappets, which push the capsules axially out of the respective receptacle, and guide flaps, functioning like a shunt, which are pivotably supported with respect to a pivot shaft and each have two guideways, one of which is associated with the good side and the other with the bad side, and which can be selected as a function of the outcome of testing of a particular capsule. The capsule receptacles and the guide flaps are arranged in rows, and one guide flap is assigned to each receptacle. The number of guide flaps corresponds to the number of capsule receptacles in the capsule delivery device. The guide flaps are controllable individually by means of an actuating device, embodied as a single-flat mechanism. The guideways of adjacent guide flaps are separated from one another by partitions, and the partitions thus form the lateral boundaries of the guideways. They are integrally formed onto a housing of the capsule expulsion station and protrude upward in the form of filigreed comblike separator ribs, which are advantageously complicated to produce.

[0006] Another disadvantage is the embodiment of a comparatively large gap between each of the individual guide flaps and the separator ribs, so that there is the risk that upon an expulsion, reinforced by suction, on the bad side of the affected guide flap, defect-free capsules can remain "stuck" on the good side.

[0007] Moreover, because of how the receptacles for the capsules in the delivery device are disposed and because the guide flaps are embodied uniformly, each guide

flap has its own pivot shaft, which in turn entails major effort and expense for assembling of the guide flaps.

[0008] Advantages of the Invention

[0009] The machine according to the invention for filling and sealing two-part capsules, in particular hard gelatin capsules, having the characteristics of the preamble to claim 1, in which machine the partitions are each an integrated component of a guide flap, have the advantage that the capsule expulsion station can have a considerably more simply produced housing than the capsule expulsion station of a machine of the prior art, since separator ribs which are complicated to manufacture and service partitions are no longer needed between the individual receptacles of the capsule delivery device.

[0010] Because of the absence of separator ribs, the housing of the capsule expulsion station is also easier to clean.

[0011] Because a gap between a body of the guide flaps that forms the guideways and an adjacent partition is also omitted, the risk that with suction support of a guideway associated with a bad side, for instance, defect-free capsules may unintentionally remain adhering to a guideway associated with a so-called good side, since the air flow from the guideway associated with the good side to the guideway associated with the bad side is reduced markedly.

[0012] In a preferred embodiment of the machine of the invention, which is easy to assemble, the various guide flaps that have a shunt function are supported on a common pivot shaft. This makes it possible to slip the guide flaps as packet onto the pivot shaft during assembly.

[0013] Often, the receptacles of the capsule delivery device are located in two parallel rows, each for instance of nine capsule receptacles. In that case, the guide flaps of the capsule expulsion station cooperate with the two rows of capsule receptacles, and the guide flaps assigned to the two rows differ from one another, specifically for instance in such a way that a rib of one guide flap form that separates the two guideways is offset laterally relative to a corresponding rib of a second guide flap form.

[0014] To reinforce the expulsion of the capsules from their receptacles of the capsule delivery device, at least one of the guideways of each guide flap can be subjected to suction. As a rule, if the guideways are subdivided into one guideway associated with the good side and one guideway associated with the bad side, the guideway on the bad side is subjected to suction.

[0015] The position of the respective guide flap upon expulsion of the respective capsule from its receptacle in the capsule delivery device is preferably dependent on the quality or fill level of the respective capsules, ascertained at at least one inspection station for the capsules. If a capsule is found good in the inspection station, the applicable guide flap is pivoted into a position such that the capsule, along the guideway associated with the good side, is expelled into a suitable container. If a

capsule in the inspection station is found to be bad, that is, defective, then the corresponding guide flap is pivoted such that the capsule is expelled along the guideway associated with the bad side. For this purpose, a control device of the actuating device for the guide flaps preferably cooperates with the inspection station for the capsules.

[0016] Further advantages and advantageous features of the subject of the invention can be learned from the description, the drawings, and the claims.

[0017] Drawings

[0018] One exemplary embodiment of a machine according to the invention is shown schematically and in simplified form in the drawings and is described in further detail in the ensuing description.

[0019] Fig. 1 is a basic plan view on a capsule filling and closing machine;

[0020] Fig. 2 is a perspective view of a capsule expulsion station of the machine of Fig. 1;

[0021] Fig. 3 is a section through the capsule expulsion station of Fig. 2, before the expulsion of a capsule;

[0022] Fig. 4 is a view corresponding to Fig. 3, but upon expulsion of a capsule assessed as a good capsule;

[0023] Fig. 5 is a view corresponding to Fig. 3, but upon expulsion of a capsule assessed as a bad capsule;

[0024] Fig. 6 is a perspective view of a first and a second guide flap of the capsule expulsion station;

[0025] Fig. 7 is a plan view on the guide flaps of Fig. 6, in which a bad capsule is expelled by means of the first guide flap and a good capsule is expelled by means of the second guide flap;

[0026] Fig. 8 shows the guide flaps of Fig. 6, in which by means of both guide flaps, one good capsule each is expelled;

[0027] Fig. 9 shows the guide flaps of Fig. 6, in which a good capsule is expelled by means of the first guide flap and a bad capsule is expelled by means of the second guide flap;

[0028] Fig. 10 shows the two guide flaps of Fig. 6, in which by means of both guide flaps, one bad capsule each is expelled;

[0029] Fig. 11 is a perspective view of the second guide flap; and

[0030] Fig. 12 is a perspective view of the first guide flap.

[0031] Description of the Exemplary Embodiment

[0032] In Fig. 1, a machine 10 for filling and sealing capsules C is shown, each capsule comprising one lower capsule part CU and upper capsule part or cap CO. The machine 10 includes, as a capsule delivery device, a feed wheel 12 rotating in increments about a vertical shaft 11, by means of which wheel twelve work stations I through XII can be approached. To this end, the capsule delivery device 12 includes twelve carriers 13, in each of which two rows offset from one another longitudinally are embodied, each containing five receptacles 14A and 14B, each for one of the capsules C.

[0033] The individual work stations I through XII of the machine 10 have different tasks in the filling of the capsules C.

[0034] For instance, at work stations I and II, the capsules C that have been put together are sorted and introduced into the receptacles 14A of the first row and into the receptacles of the second row 14B of the respective carrier 13.

[0035] After the feed wheel 12, or the carrier 13 equipped with capsules, is rotated toward the work station III, the capsules are opened there; that is, the upper capsule part CO is separated from the lower capsule part CU. Also in the work station III, the upper capsule parts CO of the capsules C placed in the carriers 13 are scanned for quality.

[0036] When the two-part carrier 13 approaches the work station V, which in this example is a powder filling station with decentralized air gap adjustment and central vacuuming for processing pharmaceutical products, the capsules C are filled, and a pneumatic readjustment of the pharmaceutical powder placed in the respective lower capsule part CU takes place.

[0037] In the work stations VII and VIII, the capsules C located in the respective carrier 13 are inspected for their fill level and/or their quality.

[0038] When the feed wheel 12 or carrier 13 reaches the work station IX, the upper capsule parts CO are put back into alignment there with the respective associated lower capsule parts CU.

[0039] After a further rotation of 30° about the shaft 11, the carrier 13 reaches the work station X, which is a closing station. The upper capsule parts CO are accordingly placed back onto the lower capsule parts CU there.

[0040] Next, the carrier 13 is advanced to the capsule expulsion station XI, in which the individual capsules C are expelled from their receptacles 14A and 14B.

[0041] After the expulsion of the capsule C, the carrier 13 is sent to a cleaning station XII, in which it is cleaned of residues of the capsule C, or of the powder placed in it.

[0042] The capsule expulsion station XI is described in further detail below in conjunction with Figs. 2 through 12.

[0043] The capsule expulsion station XI includes a housing body 15, on the inside 16 of which the carrier 13, connected to the feed wheel 12, is guided; this carrier comprises a lower carrier part 17 and an upper carrier part 18. The lower carrier part 17, which is movable horizontally, serves to receive the lower capsule parts CU, and the upper carrier part 18, which is movable vertically, serves to receive the upper capsule parts CO.

[0044] Below the carrier 13, there is an expulsion device 19, which is connected to a drive mechanism 20 and which has one tappet 21 for each of the ten receptacles 14A and 14B of the carrier 13; this tappet is displaced in the axial direction Z for expelling the applicable capsule C from the receptacles 14A and 14B assigned to the first and second rows, respectively, so that the capsules C are each expelled upward out of their respective receptacle 14A and 14B. Upon expulsion from their receptacles 14A, 14B, the capsules C are each thrust through a bore 22 in an upper housing part 23 and are then delivered to either a good side 25 or a bad side 26 by means of a shuntlike guide flap 24A and 24B, respectively. The good side 25 is intended for capsules C that have been found defect-free in the work stations VII and VIII. The bad side 26 is intended for capsules C that have been assessed as defective upon scanning in the work station IX.

[0045] The good side 25 includes a first plexiglass hood 27, which prevents an expulsion of the capsules C from the machine IX and leads to a collection container, not shown in further detail here, for perfect capsules C. The plexiglass hood 27, on its underside, forms a slideway which is aligned with a slideway 28 that is embodied on the outside of the housing body 15.

[0046] The bad side includes a second plexiglass hood 29, which likewise prevents capsules C from being expelled from the machine 10. The plexiglass hood 29 covers a collection region 30, which is embodied on the inside of the upper housing part 23.

[0047] The capsule expulsion station X has five guide flaps 24A and five further guide flaps 24B, which are supported on a common pivot shaft 31; the guide flaps 24A and the further guide flaps 24B are located in alternation in line with one another. The guide flaps 24A are assigned to the receptacles 14A of the carrier 13, and the further guide flaps 24B are assigned to the receptacles 14B of the carrier 21.

[0048] Each of the guide flaps 24A and 24B is connected to a respective guide rod 32A and 32B, by means of which a pivoting motion, which is tripped by means of an actuating device 39 shown only highly schematically here, can be imposed on the applicable guide flap 24A or 24B.

[0049] The guide rods 32A and 32B, by means of which the guide flaps 24A and 24B are actuatable, are connected to the actuating device, which cooperates with the stations VII and VIII for inspecting the capsules C and as a function of the outcome of

inspecting specifies the switching position of the guide flaps 24A and 24B, and thus specifies the guideway 33A, 33B, 34A or 34B along which the particular capsule C will be expelled toward either the good side 25 or the bad side 26. The actuating device 39 for the individually triggerable guide flaps 24A and 24B here includes pneumatic cylinders, not shown in further detail here, of which one is assigned to each guide rod 32A and 32B.

[0050] The guide flaps 24A and 24B each have two guideways, 33A and 34A; and 33B and 34B, respectively, which are formed by a rib 35A and 35B, respectively, oriented essentially parallel to the pivot shaft 31. The guideways 33A and 33B serve to feed capsules C from the receptacles 14A and 14B to the good side 25. The further guideways 34A and 34B serve to feed capsules C from the receptacles 14A and 14B to the bad side 26.

[0051] Partitions 36A and 36B are also embodied on the respective guide flaps 24A and 24B; these partitions are oriented perpendicular to the pivot shaft 31 and separate the guideways of adjacent guide flaps from one another. The partitions 36A and 36B are each an integrated component of the respective guide flap 24A and 24B and are thus made in one piece with the respective rib 35A and 35B.

[0052] The guide flaps 24A and 24B, which are each shown by themselves in Figs. 11 and 12, respectively, differ in the location of the ribs 35A and 35B and the guideways 33A and 34A; and 33B and 34B, respectively, embodied on the ribs, which guideways

are adapted to the arrangement of the rows, laterally offset from one another, of receptacles 14A and 14B of the carrier 13.

[0053] The spacing between two adjacent guide flaps 24A and 24B is defined by an annular step 37A and 37B, respectively, a few tenths of a millimeter high, which surrounds a respective bearing bore 38A and 38B, by way of which the respective guide flap 24A and 24B is suspended from the pivot shaft 31.

[0054] To reinforce the feeding of capsules C to the bad side 26 of the capsule expulsion station XI, the bad side 26 is subjected here to suction.

[0055] In Figs. 4, 5 and 7 through 10, different switching positions of the guide flaps 24A and 24B are shown. In the switching position of Figs. 4, 8 and 9, the capsule C is expelled along the guideway 33A to the good side 25. In the switching position of Figs. 5, 7 and 10, the capsule C is expelled along the guideway 34A to the bad side 26. Also in the switching position of the guide flap 24B in Figs. 7 and 8, a capsule located in a capsule receptacle 14B of the carrier 13 is expelled along the guideway 33B to the good side 25. In the switching position of the guide flap 24B in Figs. 9 and 10, the capsule C is expelled along the guideway 34B to the bad side 26.